THE OILS OF THE SEA URCHIN AND STAR FISH EGG.

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The fatty fraction of the Echinoderm ova is particularly important because there is evidence that this fraction furnishes much of the energy requirement for the development of the egg. The sterol content of the eggs has been determined and a new sterol found in the star fish egg (*Asterias forbesii*) by Page (1). The sea urchin (*Arbacia punctulata*) egg was shown to contain a rather large quantity of true cholesterol. It seemed desirable now to examine the oil contained in these eggs, the results of which analysis are presented in this paper.

Oil Content.

The eggs were removed from the ovaries, strained, and strongly centrifuged to remove as much sea water as was possible. They were then placed in a flask and extracted first with an alcohol-ether mixture followed by repeated ether extractions for eight days at 40 degrees C. in a thermostat. Some of the excess ether was allowed to evaporate at room temperature and then acetone added in large excess in order to precipitate the acetone insoluble phosphatide fractions. After standing over night the mixture was filtered and the solvent from the filtrate allowed to evaporate at room temperature. The residue from this evaporation was placed in a $CaCl_2$ desiccator and the desiccator kept in the thermostat at 40 degrees C. for 4 days. The residual oily material was then subjected to the identification procedure detailed below. The phosphatide fraction was dried at 100 degrees C. and weighed.

Protocols.

Arbacia Oil.—The oil had a brownish red color and smelled strongly of lower fatty acids. The material had a heavy consistency and tended to lump together. It was freely miscible

[1] Contribution from the Research Division of Eli Lilly and Company, Marine Biological Laboratory, Woods Hole, Mass.

with CCl_4 chloroform, ether, and acetone. From its appearance on standing it seemed to behave somewhat as a semi-drying oil. 8.3 grams of oil was obtained from 183 million eggs. The iodine number as determined by the Wijs method was 146–148, and the saponification value (Kottstörfer value) approximately 606.0.

The I_2 value is suggestive of the marine animal oils such as Menhaden and Sardine oils, also the liver oils. The high saponification value confirms the results of the volatile acid determination presented in Table I. It also suggests that much of the oil represents fatty acids of low molecular weight.

The fatty acids volatile with steam were determined by the method of Dyer (2). Twelve million *Arbacia* eggs were used. The results of the steam distillation of star fish eggs is also included. 9,160,000 of these eggs were distilled. Three hours and forty minutes were required in both cases for the distillation.

TABLE I.

DYER METHOD FOR STEAM VOLATILE FATTY ACIDS OF *Arbacia* AND *Asterias*.

Fraction.	Amount of Distillate *Arbacia*.	Amount of Distillate *Asterias*.	Cc. *N*/10 NaOH Required to Neutralize *Arbacia*.	Cc. *N*/10 NaOH Required to Neutralize *Asterias*.
1.....	13.3	7	.346	.175
2.....	24.0	14.0	.72	.350
3.....	22.0	23.9	.44	.597
4.....	20.5	19.2	.246	.480
5.....	32.0	20.7	.384	.414
6.....	18.0	34.0	.18	.510
7.....	20.0	33.5	.20	.335
8.....	26.0	39.2	.26	.196
9.....	17.0	36.6	.17	.219
10.....	56.0	43.0	.56	.215
11.....	47.0	55.0	.25	.220
12.....	40.0	13.5	.24	.067
Total.....	335.8	339.6	4.001	3.778

6,000,000 *Asterias* eggs = 2.474 cc. *N*/10 NaOH.

6,000,000 *Arbacia* eggs = 2.000 cc. *N*/10 NaOH.

Since the *Arbacia* eggs = 75 μ in diameter and *Asterias* eggs = 104 μ in diameter.

Calculating *Arbacia* volume to that of *Asterias* = 2.527 cc. *N*/10 NaOH for 6,000,000 *Arbacia* eggs.

Asterias Oil.—An orange colored oil, non-drying, pungent odor very much like vanillin, which has about the consistency of olive oil. The I_2 number (Wijs) was approximately 110–115 and saponification number 318.8. The saponification number and the physical properties of the oil suggest that a much greater proportion of high molecular weight fatty acids are present in this oil than in that of *Arbacia*.

The *Asterias* oil is present in great abundance while *Arbacia* contains much less oil. This fact seems important. Distillation of *Asterias* eggs with KOH gives very appreciable amounts of H_2S. Very little resulted from the distillation of *Arbacia*.

Phosphatide Fractions.

1.539 grams of acetone insoluble material was obtained from 183 million *Arbacia* eggs. Much of this precipitate was insoluble in boiling alcohol suggesting a high percentage of kephalin. The presence of sphingomyelin was indicated by the presence of a small amount of white precipitate on the addition of ether to the alcohol solution.

Acetone precipitates a large quantity of brownish white gummy material from *Asterias* egg extract. It was largely soluble in hot alcohol suggestive of a large proportion of lecithin. Further examination of this fraction has been deferred.

It is interesting to note that qualitatively large amounts of soaps were found especially in the *Asterias* egg.

Summary.

1. The oil of the sea urchin egg (*Arbacia punctulata*) has an I_2 number of 146–148 and saponification value of approximately 606. The star fish (*Asterias forbesii*) egg oil I_2 number is about 110–115 and saponification value 318.8.

2. Steam distillation of the eggs by the Dyer method suggests along with the Köttstorfer number that the fatty acids of the *Arbacia* egg are of a lower order than those of the *Asterias* egg.

3. Qualitatively there appears to be more kephalin in the *Arbacia* egg and more lecithin in the *Asterias*. The *Asterias* egg

appears to contain more KOH decomposable sulphur compounds than the *Arbacia* egg.

4. Qualitatively large quantities of soaps were found.

REFERENCES.

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